

WHAT IS CLAIMED IS:

1. A method of producing an optical imaging system, which has a plurality of optical elements, comprising:
 - assembling the imaging system with the optical elements substantially arranged in predefined positions;
 - measuring the imaging system with locally resolving determination of the wavefront in the exit pupil or a surface conjugate therewith belonging to the imaging system, for the locally resolving determination of wavefront errors;
 - selecting at least one surface provided as a correction surface on at least one of the optical elements, the correction surface being selected such that the correction surface is arranged in the surface of the exit pupil or a surface conjugate therewith belonging to the imaging system;
 - calculating at least one of a topography and a refractive index distribution of the at least one surface selected as the correction surface belonging to the optical element, in order to correct the wavefront error;
 - removing the at least one optical element provided with the correction surface from the imaging system;
 - locally resolving processing of the at least one correction surface, in order to produce at least one of the calculated topography and refractive index distribution of the correction surface; and
 - installing the optical element having the processed correction surface in the predefined position for the optical element in the imaging system.
2. The method according to claim 1, wherein the measurement of the imaging system is an interferometric measurement, which permits immediate determination of light path deviations via the exit pupil or a surface conjugate therewith belonging to the imaging system.
3. The method according to claim 1, wherein the measurement of the wavefront errors is carried out simultaneously for a plurality of field points.

4. Method according to claim 3, wherein the measurement of the wavefront errors is carried out for between about 10 and about 100 field points.
5. The method according to claim 1, wherein the measurement of the wavefront errors is carried out successively for a plurality of field points.
6. The method according to claim 5, wherein the measurement of the wavefront errors is carried out for between about 10 and about 100 field points.
7. The method according to claim 1, wherein a shearing interferometer with a two-dimensional wavefront source is used for the measurement.
8. The method according to claim 1, further comprising:
 - correct-coordinate averaging of the wavefront errors determined during the measurement in order to determine an average wavefront error; and
 - calculating at least one of a topography and a refractive index distribution of the correction surface such that the average wavefront error is least partly compensated.
9. The method according to claim 1, wherein a weighted average of wavefront errors is calculated and the calculation of at least one of a topography and a refractive index distribution of the correction surface is carried out such that the weighted average wavefront error can be compensated for by the correction surface.
10. The method according to claims 1, wherein a maximum value of the wavefront error and an associated location on the exit pupil or a surface conjugate therewith is determined, and wherein the calculation of at least one of a topography and a refractive index distribution of the correction surface is carried out in such a way that the maximum value is reduced to a predefined limiting value or below that value.

11. The method according to claim 1, wherein, during an assembly of the optical imaging system, at least one surface provided as a correction surface remains uncoated, and the optical imaging system with the at least one uncoated surface is measured.
12. The method according to claim 11, wherein an effect of a coating provided for the correction surface is taken into account in the calculation of the wavefront error and a subsequent calculation of at least one of a topography and a refractive index distribution of the correction surface.
13. The method according to claim 1, further comprising:
mounting the optical element having the correction surface in a separate mount;
removing the optical element with the mount;
further processing the correction surface of the optical element held in the mount;
installing the optical element held in the mount in the imaging system.
14. The method according to claim 13, wherein the further processing of the correction surface includes at least one of correct-coordinate shaping the correction surface and locally changing the refractive index of the correction surface on the basis of data from the wavefront measurement.
15. Method according to claim 14, wherein the shaping of the correction surface is carried out by ion-beam etching.
16. The method according to claim 14, wherein the locally changing the refractive index is carried out by doping with foreign atoms.
17. The method according to claim 13, wherein the further processing of the correction surface includes coating the finally processed correction surface with an optically active layer.

18. The method according to claim 17, wherein the optically active layer is an anti-reflection layer.
19. The method according to claim 17, wherein the coating is carried out at maximum temperatures of the optical element of less than about 30° C.
20. The method according to claim 13, wherein the further processing includes a locally resolving processing comprising deposition of material on an uncoated surface in order to produce the topography of the correction surface.
21. The method according to claim 13, wherein the further processing includes a locally resolving processing comprising locally resolving doping of the optical element provided with the correction surface in order to produce local refractive index variations.
22. The method according to claim 1, wherein the optical imaging system is a microlithographic projection objective.
23. An optical imaging system comprising a plurality of optical elements and at least one pupil surface between an object plane and an image plane, a correction surface being provided on at least one surface, arranged in the vicinity of the pupil surface, of an optical element that is close to the pupil, wherein at least one of a surface shape and a refractive index distribution of said correction surface deviates significantly from at least one of a surface shape and a refractive index distribution of a corresponding surface in a basic optical design of the optical imaging system.
24. The imaging system according to claim 23, wherein the correction surface is an aspherical correction surface.
25. The imaging system according to claim 24, wherein the aspherical correction surface is a nanometer asphere.

26. The imaging system according to claim 23, wherein the correction surface bears an optical coating.
27. The imaging system according to claim 23, wherein the correction surface bears an antireflection coating.
28. The imaging system according to claim 23, wherein the optical imaging system is a microlithographic projection objective.
29. A method of producing an optical imaging system, which has a plurality of optical elements, comprising:
 - assembling the imaging system with the optical elements substantially arranged in predetermined positions;
 - measuring the imaging system with locally resolving determination of the wavefront in the exit pupil or a surface conjugate therewith belonging to the imaging system, for the locally resolving determination of wavefront errors;
 - selecting at least one surface provided as a correction surface on at least one of the optical elements, the correction surface being selected such that the correction surface is arranged in the surface of the exit pupil or a surface conjugate therewith belonging to the imaging system;
 - calculating at least one of a topography and a refractive index distribution of at least one surface provided as the correction surface belonging to the optical element, in order to correct the wavefront error;
 - removing the at least one optical element provided with the correction surface from the imaging system;
 - locally resolving processing of the at least one correction surface, in order to produce at least one of the calculated topography and the refractive index distribution of the correction surface; and
 - installing the optical element having the processed correction surface in the predetermined position for the optical element in the imaging system,

wherein the locally resolving processing includes at least one of correct-coordinate shaping of the correction surface and locally changing the refractive index of the correction surface on the basis of data from the wavefront measurement.

30. A method of producing an optical imaging system, which has a plurality of optical elements, comprising:

assembling the imaging system with the optical elements substantially arranged in predefined positions;

measuring the imaging system with locally resolving determination of the wavefront in the exit pupil or a surface conjugate therewith belonging to the imaging system, for the locally resolving determination of wavefront errors;

wherein the measurement of the wavefront errors is carried out simultaneously for a plurality of field points using a shearing interferometer with a two-dimensional wavefront source;.

selecting at least one surface provided as a correction surface on at least one of the optical elements, the correction surface being selected such that the correction surface is arranged in the surface of the exit pupil or a surface conjugate therewith belonging to the imaging system;

calculating at least one of a topography and a refractive index distribution of at least one surface provided as the correction surface belonging to the optical element, in order to correct the wavefront error;

removing the at least one optical element provided with the correction surface from the imaging system;

locally resolving processing of the at least one correction surface, in order to produce at least one of the calculated topography and the refractive index distribution of the correction surface; and

installing the optical element having the processed correction surface in the predetermined position of the optical element in the imaging system.

31. A method of producing an optical imaging system, which has a plurality of optical elements, comprising:

assembling the imaging system with the optical elements substantially arranged in predetermined positions;

measuring the imaging system with locally resolving determination of the wavefront in the exit pupil or a surface conjugate therewith belonging to the imaging system, for the locally resolving determination of wavefront errors;

wherein the measuring of the imaging system is performed interferometrically, and whereby immediate determination of light path deviations via the exit pupil or a surface conjugate therewith belonging to the imaging system is permitted;

selecting at least one surface provided as a correction surface on at least one of the optical elements, the correction surface being selected such that the correction surface is arranged in the surface of the exit pupil or an surface conjugate therewith belonging to the imaging system;

mounting the optical element having the correction surface in a separate mount;

calculating at least one of a topography and a refractive index distribution of at least one surface provided as the correction surface belonging to the optical element, in order to correct the wavefront error;

removing the at least one optical element provided with a correction surface with the mount from the imaging system;

locally resolving processing of the at least one correction surface of the optical element held in the mount, in order to produce at least one of the calculated topography and refractive index distribution of the correction surface;

installing the optical element having the processed correction surface and held in the mount in the predetermined position of the optical element in the imaging system.
